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A1

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(56) List of documents mentioned in the preliminary search  
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(74) Attorney(s): Roman Law Office

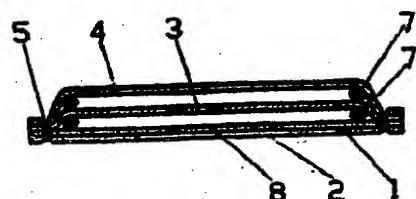
(60) References to other national related documents:

(54) Non-return valve with double outlet for protective suit.

(57) The present invention subject is a non-return valve with  
double outlet for protective suit.

It is made up with a combination of three or four flexible  
rectangular membranes (1, 2, 3, 4) of the same size, stacked  
and held together by two parallel welding lines (5) produced  
on two opposite sides, non-welded edges being free such to  
constitute double outlet for gas to exit, one of the inner  
membranes being gas-proof fixed to protective suit and  
comprising perforation (8) corresponding to a perforation on  
the suit, one or two elastic U- or M-shaped mounting  
elements (7, 71) maintained by friction between two non-  
perforated membranes ensuring a tension, which flattens  
one of the non-perforated membranes against the one  
having aforesaid perforation.

The valve is intended for gas protective equipment  
used in radioactive or toxic environments.



FR 2 688 287 - A1

## NON-RETURN VALVE WITH DOUBLE OUTLET FOR PROTECTIVE SUIT

The present invention subject is a non-return valve with double outlet for protective suit.

It is intended for gas protective equipment used in radioactive and toxic environments.

Devices produced to this day are more often made up with valves and rigid elements mounted on protruding case fixed to various locations of protective suit in order to ensure the evacuation of used gas. This equipment lacks gas-proof, is costly and requires large number of worker for their mounting. Moreover, external protrusion formed by the equipment risks to be detached and deformed.

It exists a non-return valve formed with two flexible films, one of which is perforated, closed on three sides and, holding between them a U-shaped spring, thanks to two parallel welding lines also in U-shape and located on both sides of said spring (No. FR 73 43557, of the same inventor). This device, while remedying principal defects of rigid valves, may have a sealing defect due to inner welding which has the tendency of separating both films from each other.

Another patent deposited by the applicant under No. FR 89 00417 describes similar valve formed with three flexible membranes assembled together by only one welding produced on about three-quarter of their periphery and stretched by an U-shaped spring held by friction

between two membranes and ensuring a tension, which flattens the median membrane against the perforation.

Gas evacuation flow imposed by current legislation requires, for a suit, the use of at least three or four non-return valves such as those which are the subject of two previous patents, this fact naturally increase manufacturing cost of said suit.

Device according to the present invention eliminates all these disadvantages. In fact, it allows one to obtain a completely sealed and fool-proof non-return valve, having no external protrusion, being instant deposit, therefore less expensive, produced from usual elements with very reduced cost and, ensuring sufficient gas evacuation flow in compliance with the legislation and having a maximum of two valves per suit.

It is made up with a combination of three or four flexible rectangular membranes of the same size, stacked and held together by two parallel welding lines produced on two opposite sides, non-welded edges being free such to constitute a double outlet for gas to exit, one of the inner membrane being gas-proof fixed to the protective suit and comprising one perforation corresponding to the suit perforation, one or two elastic U- or M-shaped mounting elements maintained by friction between two non-perforated membranes ensuring a tension, which flattens one of the non-perforated membranes against the one having aforesaid perforation.

In annexed drawings, provided as non-limiting example of an embodiment of the invention subject, wherein:

- figure 1 shows front view of a non-return valve having three membranes and only one M-shaped spring,
- figure 2 shows, under the same conditions, a non-return valve having three or four membranes and a U-shaped double spring,
- figure 3 shows with a different scale, a cross-section of the valve perpendicular to welding lines, according to arrows A-A in figure 1,
- figures 4 and 5 show, under the same conditions, cross-sections according to arrows B-B in figure 2 and, respectively show a three-membrane valve and a four-membrane valve,
- and figure 6 is a cross section parallel to welding lines according to arrows C-C in figure 2, showing a valve opened by the effect of gas pressure.

Device, figures 1 to 6, is made up with three or four flexible rectangular or rounded edges membranes or films 1, 2, 3, 4, made of thermosetting flexible synthetic material, held together by two parallel welding lines 5 produced on two opposite sides and stretched out by an elastic M-shaped mounting element 6 (figure 1) - or any other shape allowing one to separate both welding lines 5 -, or by two U-shaped mounting elements 7, 7'.

Inner membrane 1 comprises perforation 8 corresponding to a perforation produced in the protective suit. Perforated membrane 1 is fixed to the suit, with gas-proof welding

or bonding around said perforations such that both perforations coincide and such that gas exiting from the suit only passes between perforated membrane 1 and adjacent median membrane 2 and, exiting through double outlet formed by non-welded sides of these two membranes, according to arrows 9 in figure 6.

Elastic mounting elements 6, 7, 7' are preferably produced with steel wire. Their initial form is such that they can be slid between non-perforated membranes 2, 3, 4 and is maintained in place by friction. Simple M-shaped elastic mounting element 6 is used with three-membrane valve and is placed between median membrane 2 and outer membrane 3. U-shaped double mounting elements 7, 7' may be used either with three-membrane valves and both are then placed between median membrane 2 and outer membrane 3, or with valves having a second outer membrane 4, this arrangement allows both mounting elements to be separated by outer membrane 3. Elastic mounting elements 6, 7, 7' are intended to stretched flexible membranes 1, 2, 3, 4 such that median membrane 2 is flattened against perforated membrane 1 when external pressure is higher or equal to that inside the suit. If internal pressure of the suit becomes higher than external pressure, median membrane 2 is separated from membrane 1 and let the gas passing according to arrows 9 (figure 6). The device, which is the subject of this invention, allows one to evacuate used gas, while preventing outside gas from penetrating into the suit.

Thanks to its simplicity, its reduced volume and its low cost, the just described device is particularly suitable for producing non-return valve for pressurized protective suits intended for all kind of aggressive atmospheres.

Positioning of various constituting elements provides maximum useful effects to the invention subject, effects which weren't obtained to this date with similar devices.

## C L A I M S

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1. Non-return valve for protective suit, intended for protective equipment used in gaseous atmospheres containing radioactive or toxic elements. For the purpose of allowing the evacuation of used gas while preventing outside gas from penetrating into the suit.

**characterized** by the combination of at least three flexible rectangular or rounded-edge membranes (1, 2, 3, 4) of the same size, stacked and held together by two parallel welding lines (5) produced on two opposite edges, non-welded edges being free such to make up a double outlet for gas to exit, inner membrane (1) being gas-proof fixed to the protective suit and comprising perforation (8) corresponding to the suit perforation, at least one elastic mounting element (6 or 7, 7') maintained by friction between two or three non-perforated membranes (2, 3, 4) ensuring a tension, which flattens non-perforated median membrane (2) against the one having aforesaid perforation when external pressure is higher or equal to the suit internal pressure and, allowing said median membrane (2) to be separated from perforated membrane (1) such to ensure the evacuation of used gas (arrow 9), when the suit internal pressure exceeds external pressure.

2. Device according to claim 1, characterized by the fact that non-return valve comprises three membranes (1, 2, 3), the tension being ensured by a simple elastic M-shaped mounting element (6), or any other shape allowing one to separate both welding lines (5)

placed between median membrane (2) and outer membrane (3).

3. Device according to claim 1, characterized by the fact that non-return valve comprises three membranes (1, 2, 3), the tension being ensured by two elastic U-shaped mounting elements (7, 7'), both placed between median membrane (2) and external membrane (3).

4. Device according to claim 1, characterized by the fact that non-return valve comprises four membranes (1, 2, 3, 4), the tension being ensured by two elastic U-shaped mounting elements (7, 7') placed between median membrane (2) and two outer membranes (3, 4), both mounting elements being separated by outer membrane (3).

5. Device according to any one of previous claims, characterized by the fact that elastic mounting element(s) (6, 7, 7') is made of steel wire.

6. Device according to any one of previous claims, characterized by the fact that perforated membrane (1) is fixed to the suit with gas-proof welding or bonding around the perforations of the membrane and the suit, such that these perforations coincide and, such that gas exiting from the suit can only pass between perforated membrane (1) and adjacent median membrane (2) and exit through double outlet formed by non-welded sides of these two membranes (arrows 9).

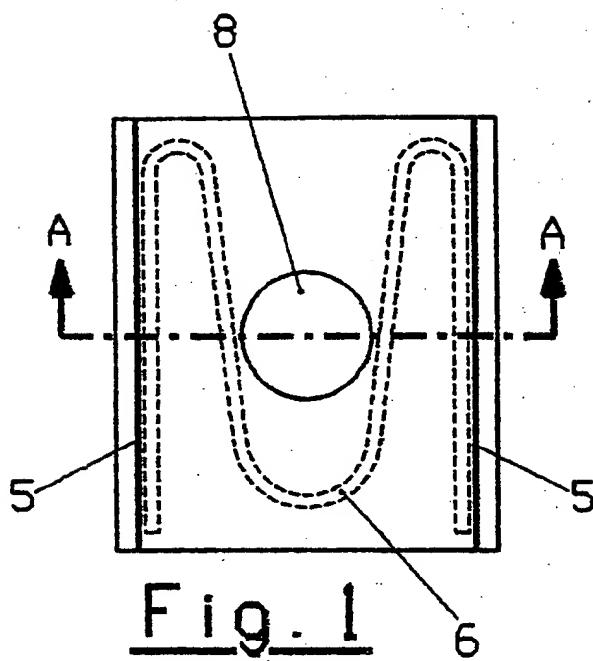
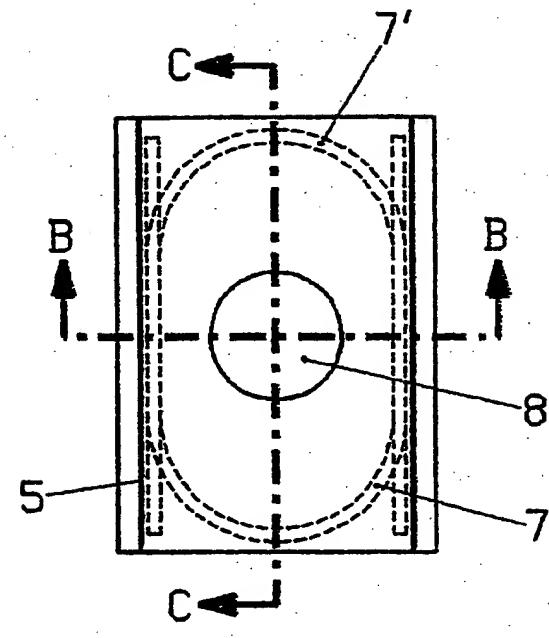
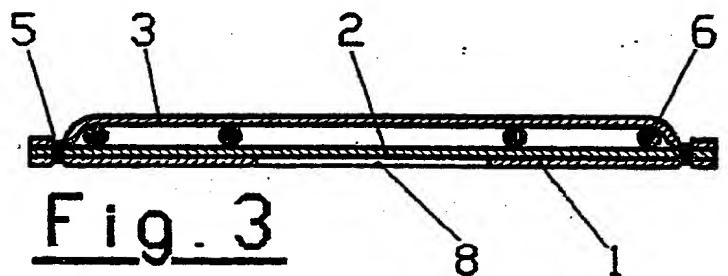
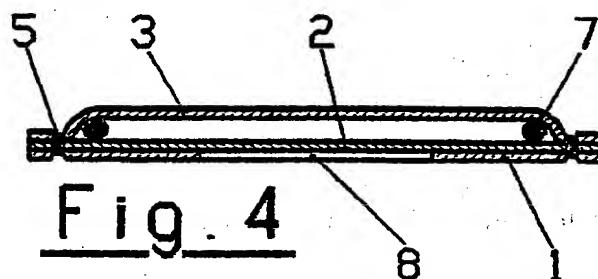
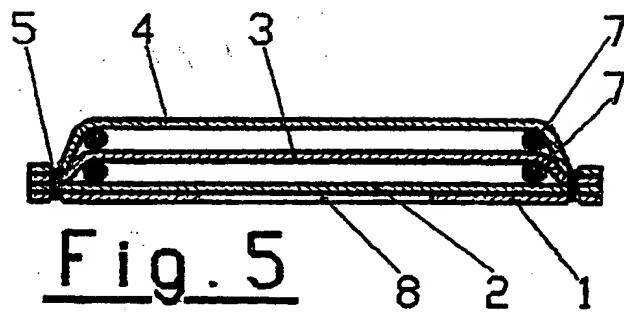
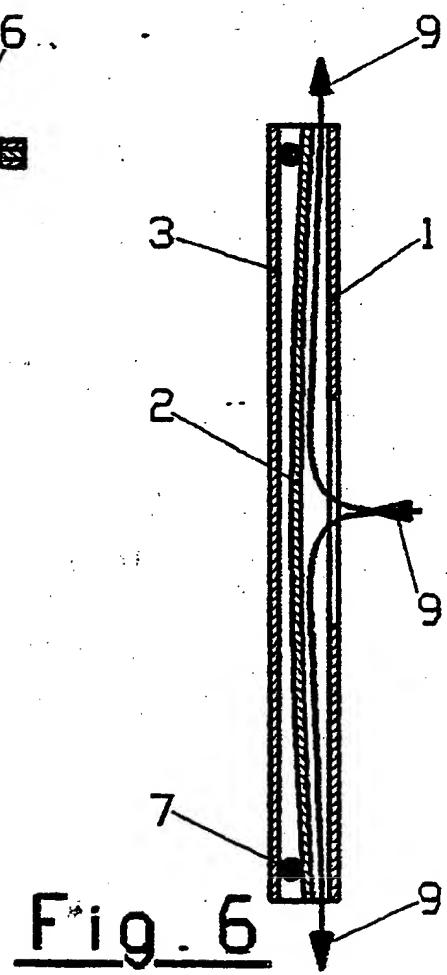
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Fig. 1Fig. 2Fig. 3Fig. 4Fig. 5Fig. 6

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FR 9202797  
FA 469079SEARCH REPORT  
established with the last claims deposited before  
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DOCUMENTS CONSIDERED AS RELEVANT		Related claims of the examined application
Category	Citation of document, with indication, where appropriate, of the relevant parts	
A	EP-A-0 274 963 (GRIZARD ET AL) * figure 5 *	1
A	AT-B-155 902 (WORTHINGTON) * claim 6, figure 10 *	1
A	FR-A-2 585 105 (DELORME ET AL) * the entire document *	1
D,A	FR-A-2 641 597 (ENJALRIC) * figures 2, 3*	1
D,A	FR-A-2 253 173 (ENJALRIC) * the entire document *	1
		SEARCHED TECHNICAL FIELDS (INT.CL. <sup>5</sup> )
		F16K A61G A61M A62B
Search completion date		Examiner
OCTOBER 22, 1992		SCHLABBACH M.
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